

TDS-NAVFAC-EXWC-EV-1509

October 2014

Alternative Metal Hot Cutting Operations for Opacity

OVERVIEW

The Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC) demonstrated an alternative fuel, for oxy-fuel cutting of metal, to reduce opacity emissions during shipbreaking and recycling operations.

When ships and submarines reach the end of their service life, they are sent to a maintenance facility for shipbreaking. The standard and most efficient procedure for deconstructing these vessels utilizes oxy-fuel metal cutting. However, this process generates visible particulate matter that has the potential to exceed local air quality limits on opacity (the visual density of smoke or particulate emissions). In the face of increasing opacity limits across the world, the Navy needs a new approach to ensure it can meet its shipbreaking mission within the regulated opacity limits. Other facilities or installations with large-scale metal cutting applications (e.g., demilitarizing aircraft, tanks, etc.) may become potential customers for the alternative fuel gases.

Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS&IMF) uses enclosures, covering sections of the submarine, to capture the smoke which is then routed through filtered exhaust systems. Unfortunately, this strategy is not practical for large surface ships

PROJECT SELECTION

The Navy Environmental Sustainability Development to Integration (NESDI) Program sponsored an Initiation Decision Report (IDR) to research alternatives to the oxy-fuel metal cutting technology. Ultimately, the project team identified nearly twenty potential metal cutting technologies to review. Each competing alternative was ranked as either “potential”

or “deprioritized” based on visible particulate emissions, cutting speed, capital cost, and operation and maintenance cost.

One of the most promising technologies, a natural gas alternative fuel made from the gasification of industrial, municipal, agricultural and military liquid wastes (e.g., ethylene glycol), was chosen (proposed benefits outlined below) for demonstration (see Figure 1) and validation.

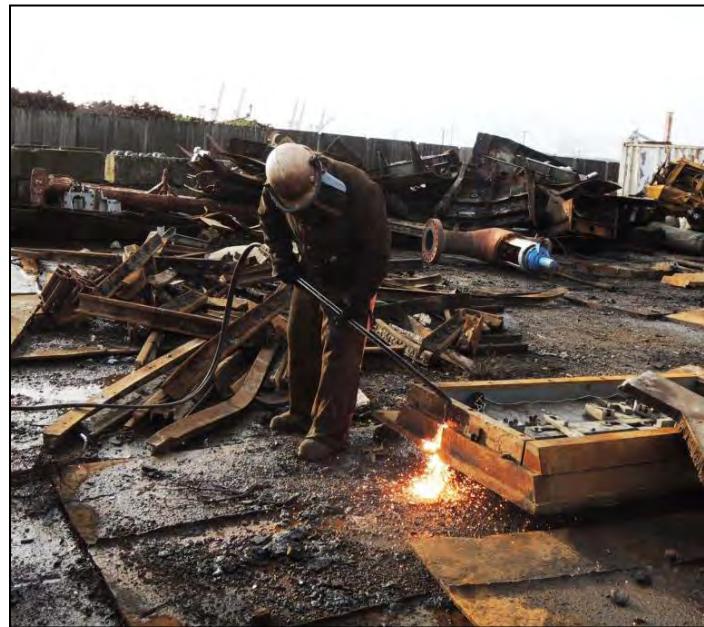


Figure 1: Demonstration of alternative gasified hot-cutting fuel.

PROPOSED BENEFITS

- 1) Sustainability. Alternative cutting fuel will increase the cutting options.
- 2) The gasified waste fuel is a drop-in replacement for propane. It offers similar cutting speed to propane and may be used with existing cutting torches.

- 3) Environmental compliance. Use of alternative cutting fuel will produce lower opacity levels than the oxy-propane thermal cutting.
- 4) Potential opportunity to contribute to waste management. PSNS&IMF may be able to contract for continuous supply of the alternative fuel. Local production of the alternative fuel could be explored, with the additional benefit to recycle used antifreeze, oily bilge water, and other appropriate spent industrial chemicals, resulting in reduced waste disposal costs.

PROJECT DESCRIPTION

Although the gasified fuel alternative was reported to reduce particulate emissions, it was not known whether actual opacity would be lower than that of propane metal cutting technologies. To make this determination, the alternative fuel was compared side-by-side with propane at PSNS&IMF (see Figure 2). The demonstration evaluated the alternative fuel on the following criteria: 1) Cutting speed vs. propane; 2) Less than 20% opacity; 3) Opacity levels vs. propane; and 4) Operation cost vs. propane.



Figure 2: Opacity comparison testing oxy-fuel cutting of deck section.

TESTING RESULTS

The testing conducted at PSNS&IMF determined: 1) propane cut significantly faster than the alternative fuel; 2) the alternative fuel produced less than 20% opacity; 3) opacity levels were equivalent between propane and the alternative fuel; and 4) operational cost of using the alternative fuel was much greater than using propane.

RECOMMENDATIONS

Unfortunately, the alternative fuel did not perform better than propane for opacity nor the other performance objectives.

Based on these demonstration results, PSNS&IMF is not interested in further field testing, of this fuel or other alternative cutting fuels, until these fuels have been thoroughly tested and validated in independent laboratory trials.

REFERENCES

Evaluated Technologies to Control/Reduce Emissions from Metal Cutting Operations, TR-NAVFAC ESC-EV-1205, March 2012.

Alternative Metal Hot Cutting Operations for Opacity, TR-NAVFAC-EXWC-EV-1409, November 2014.

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